Fall 2004

RPM News

▲ Remedial Project Manager News ▲

"Communicating Navy Installation Restoration Program News and Information Among All Participants"

In This Issue

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Risk Assessment of Trichloroethene in Soils/Groundwater/ Indoor Air In Support of RI/FS and Early Property Transfer

NWIRP Toledo

Project Summary

The Naval Weapons Industrial Reserve Plant (NWIRP) facility, located in Toledo, Ohio, is a current operating facility that dates back to the early 1940s. The facility is over 20 acres in size and is dominated by a very large, multi-acre manufacturing building (Building 1). It has historically been used and is currently used for the testing and manufacturing of engines.

An Environmental Baseline Survey (EBS) was initiated by the United States Department of the Navy (U.S. DON) in response to the Toledo-Lucas County Port Authority's (Port Authority's) interest in acquiring NWIRP. Volatile organic contamination (primarily trichloroethene [TCE]) was detected in suspected source area soil and groundwater samples collected to support the EBS. Consequently, a Remedial Investigation (RI) was conducted to determine the nature and extent of volatile organic chemical (VOC) contamination and to characterize risk for current and hypothetical future receptors.

The environmental media sampled during the RI included surface and subsurface soils, groundwater, soil gas, and indoor air. Soil gas and indoor air samples were collected from within Building 1 (Figure 1) and at background locations because preliminary modeling of the potential for TCE migration from the underlying soils and groundwater to the indoor air (using the conservative Johnson and Ettinger Vapor Intrusion Model) suggested that the indoor air concentrations within Building 1 may exceed risk-based concentrations associated with the 1 x 10^{-4} cancer risk level. A certified industrial hygienist also surveyed Building 1 for "confounding sources" (e.g., chemical storage and usage) that often contribute to the presence of VOCs in indoor air. "Confounding sources" were found within Building 1 and were considered in the risk assessment.

Figure 1: Photo of Building 1 at NWIRP Toledo.

The maximum TCE concentrations detected in all RI media exceeded the conservative toxicity screening levels typically used to select chemicals of potential concern (COPCs) for human health risk assessment. The TCE contaminant plume detected in the shallow groundwater aquifer extends to the north beyond the facility boundary (Figure 2). However, TCE contamination underlying and downgradient of Building 1 is a "hot-spot" in nature (i.e., high level contamination is not pervasive across the site).

The current and future human receptors evaluated in the human health risk assessment (HHRA) presented in the RI were the current/future indoor workers within Building 1, current/future offsite groundwater receptors, current/future construction workers, hypothetical future industrial workers, and hypothetical future residents. However, in terms of the desired property transfer, the current indoor workers within Building 1 were the most critical receptors (inhalation-of-indoor-air-pathway) because all other receptors could be protected using deed restrictions/land use controls. The risk estimates for current indoor workers potentially exposed to TCE detected in the indoor air samples did not exceed 1x 10^{-4}, an important EPA risk management benchmark. The RI risk estimates were based on the non-conservative end of the EPA cancer slope factor (CSF) range proposed for TCE (0.02 mg/kg/day)$^{-1}$. This toxicity value was recommended because the scientific literature supported the use of the non-conservative end of the proposed CSF range for a worker population. (Remedial decisions were not based on the conservative/more restrictive end of the EPA CSF range [0.4 mg/kg/day]$^{-1}$.) The RI risk assessment results were critical to the preparation and approval of the Finding of Suitability for Early Transfer (FOSET) for NWIRP. It is anticipated that the U.S. Navy experience at NWIRP regarding TCE will assist other DoD facilities facing similar issues.

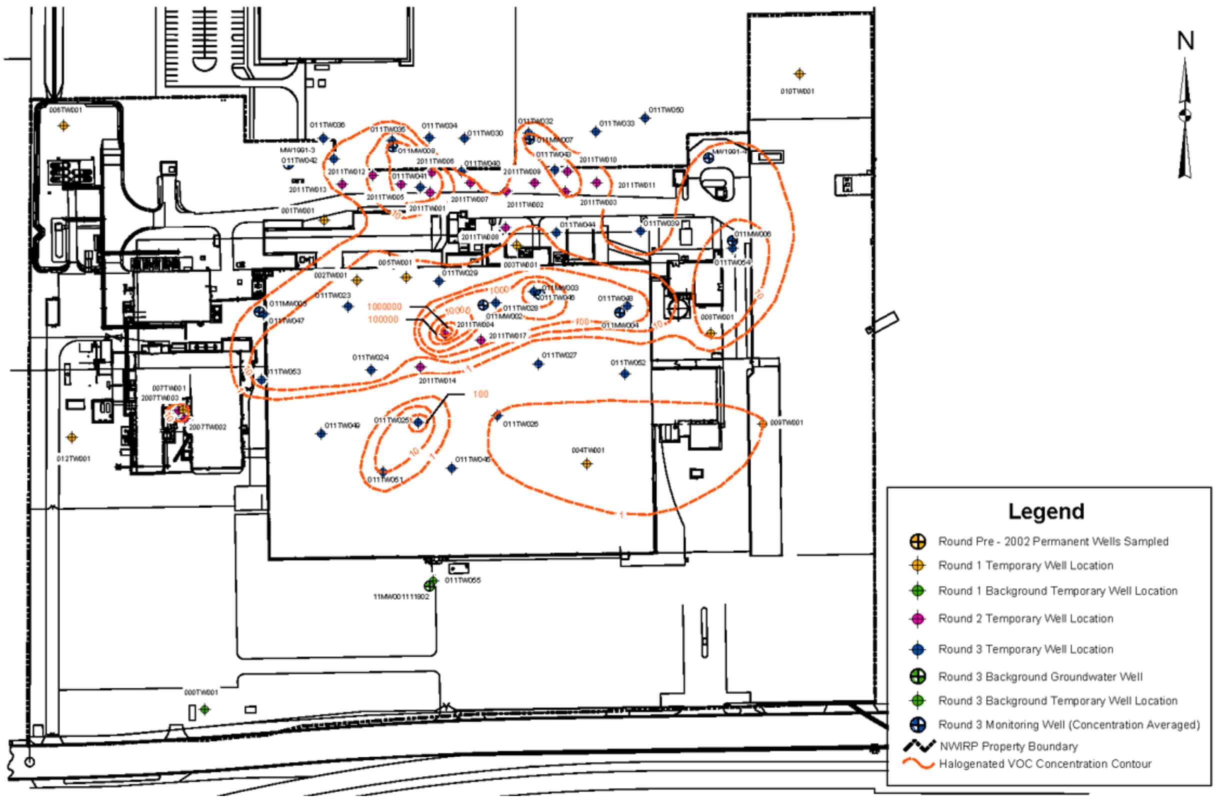

Figure 2. Halogenated (TCA/TCE Family) VOC Concentration Contour Map.

Regulatory Requirements/Community Involvement

The HHRA, RI Report, and FOSET were reviewed and approved by the Ohio Environmental Protection Agency (OEPA). The OEPA approved the use of the CSF suggested for TCE in the HHRA. In fact, subsequent to the approval of the RI, the OEPA published guidance recommending a CSF for TCE that was slightly less conservative than the toxicity value used in the HHRA (0.007 $mg/kg/day)^{-1}$.

Cost Avoidance Measures

The use of the conservative EPA CSF (0.4 $mg/kg/day)^{-1}$ would have unnecessarily complicated and delayed the early transfer of property at NWIRP. It could have also adversely impacted desired economic development efforts while providing minimal improvement in protection of human health and the environment. Also, risk management decisions based on the results of the conservative Johnson and Ettinger Vapor Intrusion Model alone may have been very difficult. Actual data from the indoor air samples and the “confounding sources” evaluation allowed risk management decisions to be made in a timely manner.

Project Successes

The proper and skilled use of the risk assessment tool, the timely collection of indoor air samples, and the “confounding sources” evaluation successfully supported the request for property transfer.

Lessons Learned

Other DoD facilities facing the evaluation/potential remediation of TCE in environmental media should carefully evaluate the available toxicity criteria for the calculation of cancer and non-cancer risk estimates, and the need for indoor air sampling. The conservative nature of some of the existing draft EPA values and the Johnson and Ettinger Model may lead to an over-estimation of risk and unnecessary remediation.

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Groundwater Containment Barrier And Extraction Trench—Investigation Area H1—Interim Remedial Action Plan

Mare Island Naval Shipyard, Vallejo, California

http://www.efdsw.navfac.navy.mil/Environmental/MareIsland.htm

Introduction

The Department of the Navy (DON) has prepared this fact sheet to inform the community about a proposed environmental remediation activity referred to as an “Interim Remedial Action” (IRA) at Mare Island in Vallejo, California. The plan is to construct a vertical groundwater containment barrier and extraction trench around a portion of the historical landfill area known as Investigation Area H1. The objective of the vertical barrier and extraction trench is to prevent contaminated shallow groundwater from migrating toward nearby wetlands and tidal marshes. This proposed action is considered an IRA, which is consistent with the reasonably anticipated final remedies for areas of Investigation Area H1 posing an unacceptable risk to human health or the environment.

Proposed Containment Areas

Investigation Area H1 (shown in red on Figure 1) includes an area of about 230 acres. The proposed vertical barrier (shown in blue) will provide groundwater containment for about 70 acres of the following areas:

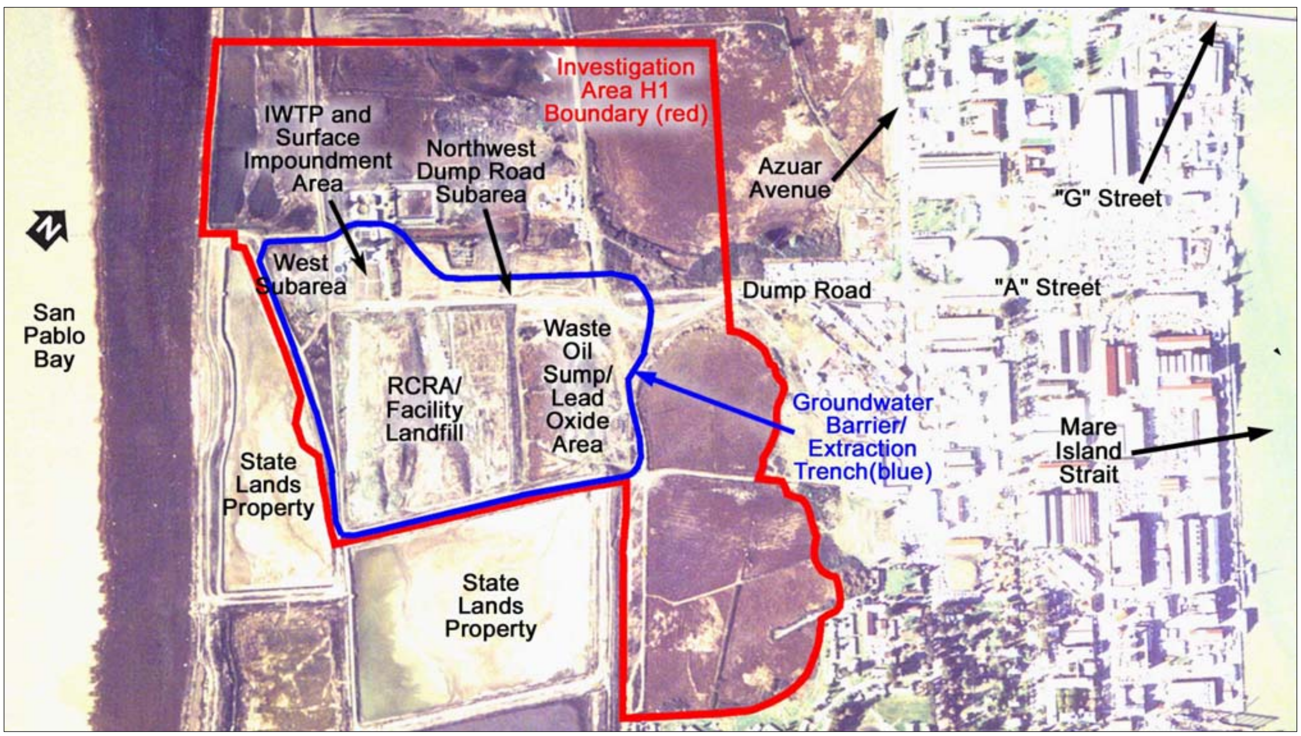

Figure 1. Alignment of the groundwater barrier and extraction trench (shown in blue) within investigation area h1 (shown in red).

RCRA/Facility Landfill Area—Includes the original Facility Landfill, which operated from 1965 to 1977 and the later Resource Conservation and Recovery Act (RCRA) Landfill used through 1989. Wastes disposed of at the Landfill were not documented, but are estimated to include over 600,000 tons of garbage, scrap metal and wood, shipboard waste, and other wastes associated with typical shipyard operations. As a RCRA Interim Status Facility, the Landfill was prohibited from accepting most hazardous wastes; however, it received certain RCRA-type wastes (asbestos-containing materials, solvent-laden rags, paint sludge, and spent sandblast abrasives).

Waste Oil Sump Area—Three unlined sumps had been constructed just south of Dump Road by 1946 for the disposal of petroleum waste oils, engine lubricating oils, and cutting oils from machine shops. Over the years of shipyard operations, the sumps reportedly received an estimated 4.5 million gallons of waste oil. The sumps were backfilled with soil in the early 1970’s. Free product hydrocarbons are present throughout much of this area.

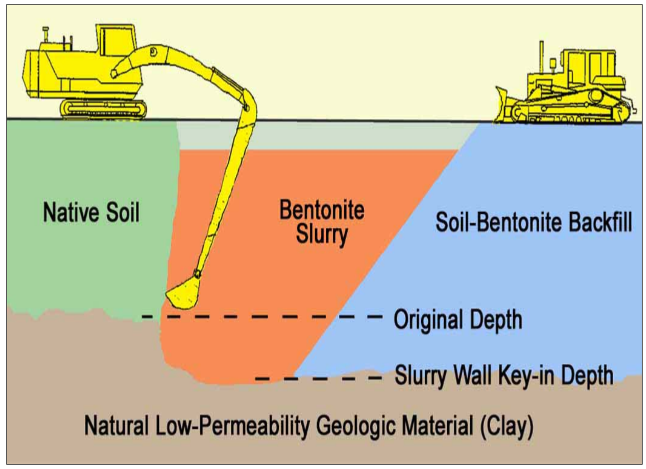

Figure 2. Side view of the slurry wall construction.

Lead Oxide Storage Area—Spent lead-acid batteries from submarines, forklifts, and vehicles were temporarily stored and disposed of in the area. The area apparently was also used for the disposal of spent sand blast abrasives. Part of this area overlies the Waste Oil Sump Area.

IWTP and Sludge Treatment/Surface Impoundment Area—The Industrial Wastewater Treatment Facility (IWTP), includes two blending impoundments, two sludge drying impoundments, and associated facilities. The facility was used to treat industrial wastewater streams from shipyard operations between 1976 and 1995. The unlined impoundments were removed from service in 1988 and covered with soil in 1989.

Northwest Dump Road Subarea—This area was used as a landfill until the late 1950's or early 1960's. Dump Road, running through the southern portion of the subarea, was built on fill consisting primarily of soil, construction debris, and large rock and concrete fragments. Free product hydrocarbons are present in a portion of the area.

West Subarea—The West Subarea is located just west of the RCRA/Facility Landfill and IWTP facility, covering approximately 10 acres of levees and portions of former Dredge Ponds 1 and 2N. Specific types of material disposed of in the West Subarea are not known but are suspected to be similar to those disposed of in the Landfill and Northwest Dump Road Subarea.

Figure 3. A typical bentonite slurry-filled trench prior to backfill with soil-bentonite mixture.

Site Evaluation

Soil, sediment, surface water and groundwater within Investigation Area H1 have been extensively sampled for contaminants. Several documents, including two remedial investigations, concluded that there exists an unacceptable risk to ecological receptors and human health. The proposed vertical containment barrier completely surrounds the three major potential sources of groundwater contamination within Investigation Area H1; the RCRA/Facility Landfill, the Waste Oil Sump/Lead Oxide Area, and the IWTP sludge impoundments.

The objective of this IRA is to contain these potential sources of groundwater contamination and prevent the lateral migration of contaminants into the adjacent tidal marshes and wetlands comprising a portion of the Western Early Transfer Parcel, which was recently transferred to the State of California. Downward migration is limited by the thick layers of natural low-permeability geologic material (clay), which underlies the site.

Proposed Action

The reasonably anticipated final remedies for the historic landfill areas within Investigation Area H1 include vertical and horizontal containment, excavation and consolidation on-site, excavation and off-site disposal, or a combination of these remedies. This time critical IRA is consistent with these anticipated final remedies, and it will prevent the migration of the contaminated shallow groundwater until the final remedies are implemented. The IRA will include the following elements:

Containment Barrier—Approximately 7,200 linear feet of a vertical barrier will surround the major groundwater contaminant sources within Investigation Area H1. The barrier will be constructed of a soil-bentonite mixture (*slurry wall).* Bentonite is a natural clay mineral, which swells when mixed with water and makes a flexible and nearly impermeable barrier to water movement. The slurry wall will be constructed by excavating a 3-foot wide trench, which is then filled with a water-bentonite slurry during the excavation process as shown in Figures 2 and 3.

The water-bentonite slurry prevents groundwater intrusion into the trench and maintains integrity of the excavation sidewalls.

The trench will then be filled with a mixture of the excavated soil and bentonite slurry. This technology has been used for decades as a key component of levees to contain rivers within urban, navigation, and agricultural areas. Depth of the slurry wall will range from 15 to 25 feet below the surface. The slurry wall will be extended five feet into the thick layer of natural, low-permeability geologic material (clay) underlying the containment area as shown in Figure 4.

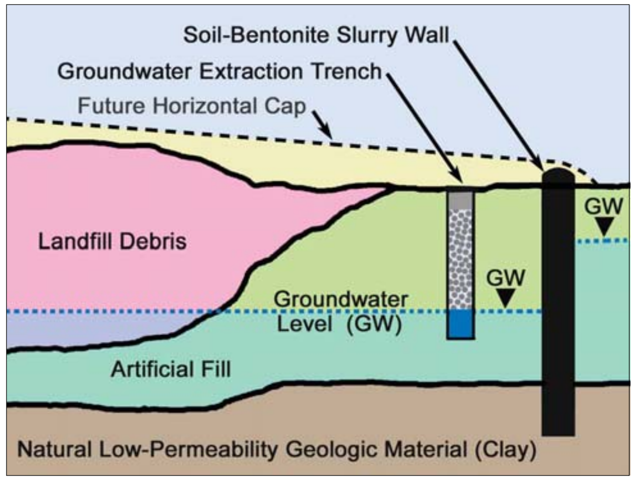

Figure 4. Cross-section view of extraction trench and slurry wall.

Groundwater Extraction Trench—A trench located approximately 20 feet inside the slurry wall will collect contaminated groundwater from the inside of the containment area. The 8 to 10 foot deep trench will consist of a horizontal perforated pipe within drain rock and a number of sumps and pumps to extract and convey groundwater to a central treatment location. The level of groundwater inside the slurry wall will be maintained lower than the groundwater level outside the slurry wall to ensure an inward hydraulic gradient toward the containment area (shown in Figure 4). This will prevent any contaminated groundwater from escaping the containment area even if the slurry wall becomes damaged.

Groundwater Treatment System—The groundwater collected from the extraction trench will be conveyed to a small treatment enclosure located approximately 600 feet away from the containment barrier boundary where free product hydrocarbons (oil) will be removed with an oil/water separator. Elevated levels of naturally occurring arsenic in groundwater, if present, will also be reduced prior to discharge. Treated water from the plant will meet acceptance requirements of the Vallejo Sanitary and Flood Control District. The flow rate of extracted groundwater is expected to be less than 40 gallons per minute. The Navy will operate the groundwater extraction and treatment system as part of the overall containment and long-term monitoring if on-site containment is part of the selected final remedy.

Containment System Monitoring—Groundwater monitoring wells and piezometers will be used to collect groundwater samples. Groundwater elevations within and around the slurry wall will be observed to ensure that an inward groundwater gradient is maintained and that contaminants are not migrating away from the containment area. Funding has been provided by the Navy for landfill groundwater monitoring, which will be continued for a minimum of 30 years or in perpetuity if necessary.

Regulatory Considerations

This IRA for Investigation Area H1 is consistent with the factors set forth in the National Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which allow the use of engineering controls such as containment for waste that poses a relatively low long-term threat.

Interim Remedial Action (IRA) Plan

An IRA Plan has been prepared consistent with the factors set forth in the NCP. The implementation of this IRA Plan will reduce risks to human health or the environment from migration of contaminated groundwater until the final remedies are in place.

California Environmental Quality Act (CEQA)

The California Department of Toxic Substances Control (DTSC) has prepared an Initial Study to evaluate the potential impacts to the environment. DTSC has determined that the project will not have a significant impact on the environment and intends to issue a CEQA negative declaration.

Point of Contact

(619) 532-0975

Treated Soil Recycled for Use in Parking Lot Construction at Naval Support Activity, Mechanicsburg, Pennsylvania

Introduction

The Naval Facilities Engineering Command (NAVFAC) is currently working with Encapco Technologies, LLC to test their patented emulsion stabilization technology at several sites for the treatment of soils impacted by heavy metals, explosive compounds, radionuclides, and other contaminants. The Encapco technology involves mixing contaminated soil into an asphalt or tall oil pitch (TOP) emulsion that is chemically enhanced to bind and stabilize the target contaminants. The stabilized and encapsulated soil is then ready for reuse as a valuable construction material for road base, covers, berms, or fill. The objectives of NAVFAC’s on-going demonstration program are to evaluate the implementability of the Encapco soil stabilization technology, to document the cost and performance of the technology, and to obtain regulatory support for the overall treatment approach and product reuse options. This article summarizes the results of the Encapco demonstration project at the Naval Support Activity (NSA) in Mechanicsburg, Pennsylvania including the site background, project-specific objectives, technology implementation, and primary conclusions of the cost and performance assessment.

Site Background

NSA Mechanicsburg was commissioned during World War II as an inland supply depot to support Navy operations worldwide. The primary mission of NSA Mechanicsburg is to procure, store, and maintain certain strategic and critical materials important to the Navy’s national defense mission. The facility is home to numerous commands such as the Naval Inventory Control Point, which manages the inventory control for a broad range of goods and services used in ships, submarines, ship weapon systems, naval aircraft, and aircraft weapon systems. Another important tenant unit is the Navy Ammunition Logistics Center, which is responsible for maintaining a supply of lead and zinc destined to become part of the U.S. Navy’s ammunition. NSA Mechanicsburg has served as a repository for approximately 90,000 tons of lead and zinc ingots that were stored outdoors since the early 1950’s in four storage areas numbered 317, 413, 414, and 606 (See Figure 1). This practice left the ingots exposed to decades of weathering and resulted in an impact to the surrounding soil with lead and zinc. The ingots were removed from all outdoor storage areas in 2002 and placed in covered warehouses.

Figure 2. Lead ingots stacked within fenced area

Based on discussions with project stakeholders including Base personnel and regulatory agencies, it was decided to conduct the Encapco demonstration project at Storage Area 413 and to reuse the resulting Encapco-treated soil product as the base for a nearby parking lot. Lead and zinc were the only soil contaminants known to exceed human health exposure criteria at Area 413. A previous site investigation around Area 413 verified lead and zinc contamination in surface soils at concentrations of up to 20,400 milligrams per kilogram (mg/kg) and 3,720 mg/kg respectively. In addition, toxicity characteristic leaching procedure (TCLP) data from one soil sample collected during Encapco’s site visit in June 2003 showed a concentration of 6.4 milligrams per liter (mg/L) of lead in the leachate, which exceeded the applicable hazardous waste threshold for lead. Based on further site investigation activities in June 2003, it was determined that approximately 500 tons of soil at Area 413 would require excavation and treatment to meet human health exposure criteria for lead and zinc. It was also determined that the elevated lead and zinc levels were primarily located from the surface to a depth of 4-inches below ground surface (bgs) and that soils at a depth of 1 ft bgs were below the applicable human health criteria for lead and zinc.

Project Objectives

The purpose of this demonstration was to evaluate the effectiveness and cost associated with the Encapco process for treating lead and zinc contaminated soil at NSA Mechanicsburg. The following list summarizes the project-specific objectives**:**

- *Evaluate lead and zinc levels in the surface soil at Area 413;*
- *Determine a suitable emulsion design for the clayey soil conditions at the site;*

- *Evaluate the ability of the emulsion to reduce lead and zinc leaching from treated soil to below TCLP standards of <0.75 mg/L for lead and <4.3 mg/L for zinc; and*
- *Estimate costs and compare them with the costs of traditional soil disposal at a hazardous waste landfill.*

Technology Implementation

Encapco's stabilization method can be implemented either ex situ or in situ. This physical-chemical treatment technology for the cleanup of contaminated soil was patented in 1999 under U.S. Patent No. 5,968,245 and is licensed by Encapco Technologies LLC. It involves mixing contaminated soil into an asphalt or tall oil pitch (TOP) emulsion that is chemically enhanced to bind and stabilize the target contaminants. During the Encapco process, chelating and/or precipitating agents are added into the asphalt emulsion to promote chemical bonding of the target contaminants. As the asphalt emulsion coalesces, cures, and solidifies, the contaminants in the soil are both chemically stabilized and physically encapsulated. The overall treatment objective is to minimize contaminant leaching, while retaining the overall adhesiveness, durability, and water-resistance of the final asphalt base product.

A typical emulsion formulation is provided in Table 1. A site-specific formula was developed for the NSA Mechanicsburg site based on the results of an initial treatability study (ITS) conducted in October 2002. The results of the ITS demonstrated that the Encapco emulsion could successfully stabilize the clayey soils from the site to achieve TCLP values of 0.4 mg/L for lead and 0.75 mg/L for zinc, which were well below the hazardous waste thresholds determined by the Resource Conservation and Recovery Act (RCRA).

Figure 2 shows the major equipment involved in the ex situ treatment process. A feed hopper is used for storage of excavated soil and a tanker truck is used to hold the asphalt or TOP emulsion. A pug mill mixer is then used to blend and thoroughly mix the soil and emulsion prior to placement into a dump truck. An array of mist spray bars and hoses are used for dust control. After treatment, the final product is a stabilized and encapsulated soil that can then be used for road base, covers, berms, fill, or other purposes.

Material	Volume
Tall Oil Pitch or Asphalt	50%
Non-ionic Surfactant	2%
Water	42%
Acid- Proprietary	6%

Table 1. Typical Emulsion Formulation

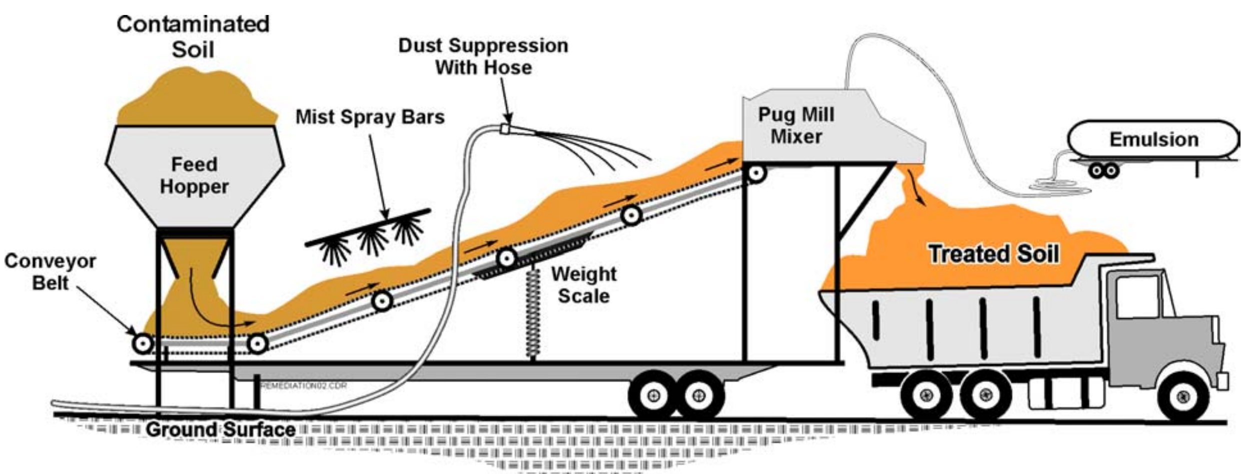

Figure 2. Encapco Treatment Schematic

The fieldwork at NSA Mechanicsburg was conducted from 6 October through 17 October 2003. The first step consisted of soil excavation and screening of approximately 700 tons of soil (see Figure 3a). After passing the soil through a screen and removing pieces of soil and gravel greater than one inch, approximately 500 tons of lead and zinc contaminated soil were deemed suitable for processing. Following excavation, the soil was placed in a temporary stockpile and quicklime was added to remove excess moisture. Subsequently, a tanker truck delivered the Encapco emulsion, which was mixed with the soil in a pug mill (Figure 3b). The liquid emulsion was delivered to the job site and was then proportioned and mixed with the soil at a temperature between 90°F and 120°F. The quantity of water added to the mixture was adjusted to produce the optimum moisture content of the soil. As the soil was mixed, a total of 10 pre- and post-treatment grab samples were obtained from the first 100-ton test run and at every 100-ton batch thereafter to provide data on the performance of the process. The samples were submitted for total lead and zinc analysis using USEPA Method 6010 and TCLP analysis using USEPA Method 1311/6010. After treatment, the soil was placed in a second temporary stockpile and covered with plastic sheeting, until the plans to use the asphalt mix as parking lot sub-base/base were implemented. Next, the treated soil was laid down in the excavated area in 8-inch lifts and compacted with an 8 ton Ingersoll-Rand smooth wheel compactor (see Figure 3c). After compaction was completed, Encapco collected four in-place treated soil samples from the compacted sub-base/base of the parking lot. The samples were analyzed using USEPA Method 6010 for total lead and zinc and 1311/6010 for TCLP lead and zinc concentrations.

Figure 3. Encapco Treatment Process at NSA Mechanicsburg, PA
From top to bottom the photographs show the following:
(a) soil excavation and screening process;
(b) pug mill and emulsion tanker truck; and
(c) treated soil awaiting compaction and surfacing.

Performance Assessment Conclusions

The performance assessment for the NSA Mechanicsburg project included an evaluation of the reduction in contaminant mobility and leachability by comparing before and after treatment TCLP results for lead and zinc. The performance assessment also included the analysis of supplemental geotechnical criteria to assess the suitability of the emulsified soil product for reuse as sub-base/base for the parking lot including the treated product's permeability, stability, and flow under heavy loads. The after-treatment TCLP results from the compacted soil samples are summarized below in Table 2. As shown in Table 2, the TCLP values for lead were all less than 0.11 mg/L and met the RCRA TCLP standard of <0.75 mg/L for lead. The TCLP values for zinc were all less than 0.33 mg/L and met the RCRA TCLP standard of <4.3 mg/L for zinc.

The treated product showed a relatively low permeability ranging from 2.2×10^{-5} cm/s to 5.2×10^{-5} cm/s, but these values were still slightly elevated compared to the performance target of less than 1.0×10^{-5} cm/s. After optimization of the cement mix for the second and third test runs, the treated product was also able to meet the required strength and flow characteristics evaluated by the Marshall Test for use on roads subject to heavy traffic.

The total cost for the demonstration project is reported in Table 3, along with an analysis of the unit cost for the treatment of 500 tons of lead and zinc impacted soil at the NSA Mechanicsburg site. The major cost drivers for the Encapco process include equipment charges (including capital rental equipment costs, equipment repair, maintenance, and fuel), labor, material (including the Encapco mixture), permitting, utilities location, location surveying, oversight, and work plan/report preparation. The unit cost for the demonstration project is relatively high due to the small volume of soil treated at 500 tons. However, it is still below literature values reported for excavation and off-site treatment and disposal, which are reported to range from \$200 to \$460 per ton for hazardous waste. Figure 4 shows the predicted effect of scale on the unit cost of Encapco treatment. For example, with

Sample ID	Pb (TCLP)	Total Pb	Zn (TCLP)	Total Zn
	mg/L	mg/Kg	mg/L	mg/Kg
Northwest	<0.11	746	<0.33	115
Northeast	<0.11	742	<0.33	121
Southwest	<0.11	761	<0.33	105
Southeast	<0.11	789	<0.33	130

Table 2. Total and TCLP Lead and Zinc Concentrations on Compacted Samples

7000 tons of soil, the unit cost per ton of treated soil would decrease to approximately $43 per ton. Due to these scalability issues, 500 tons of soil is the minimum quantity of soil that is recommended to be treated by the Encapco process, while still maintaining its cost effectiveness compared to off-site disposal as hazardous waste.

Task Description	Cost
Treatability Study	$5,800.00
Mobilization/Demobilization	$5,878.92
Site Preparation and Excavation	$11,811.36
Load, Screen, and Treat Soils	$11,651.75
Backfill and Site Restoration	$1,171.16
Labor, Overhead, and Profit	$25,394.60
Asphalt	$17,784.03
Total	$79,491.82
Output 500 tons	500 tons
Unit Cost Per Ton	$158.98

Table 3. NSA Mechanicsburg, PA. Demonstration Costs

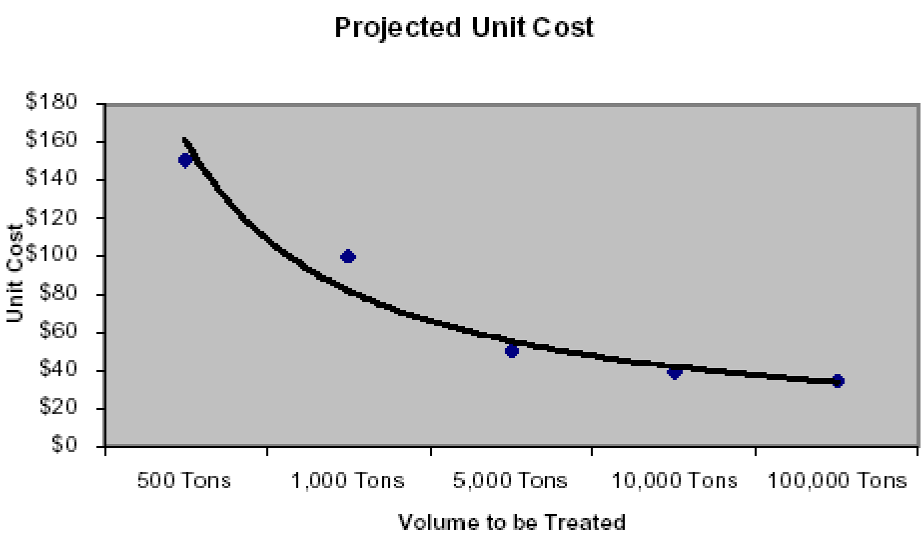

Figure 4. Expected reduction in costs for Encapco Treatment with increasing project scale.

Point of Contact

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Early Transfer Facilitates Development of 143 Acres in City of Louisville

NOS Louisville

Background

Naval Ordnance Station (NOS) Louisville (Figure 1) is located on about 143 acres of land in Louisville, in south Jefferson County, Kentucky. It is about seven miles southeast of downtown Louisville and half a mile west of Louisville International Airport.

Figure 1. Aerial Photo of NOS Louisville.

The facility began operations in late 1941 as a Government-owned, contractor-operated facility. NOS Louisville mass-produced, machined, and assembled weapons systems for the Navy. It produced large quantities of shell casings and gun mounts for use in World War II.

Under the Defense Base Closure and Realignment Act (BRAC) of 1990 and 1995 amendments, NOS Louisville was slated for closure as a Government facility, but was selected for reuse under the privatization program. The Louisville/Jefferson County Redevelopment Authority (LJCRA) proposed to continue operations with contracts to United Defense Limited Partnership and Hughes Corporation (now owned by Raytheon). The Navy accepted this plan and the facility was privatized on 18 August 1996, under an interim lease to the LJCRA from the Navy. The LJCRA renamed the facility Technology Park of Greater Louisville, and plans to continue supporting the Navy by manufacturing and refurbishing weapons systems. Plans include converting existing buildings for other industrial uses. In addition, an area will be set aside for recreational use by the Beechmont Youth Sports Association.

On 30 September 1997, the Naval Facilities Engineering Command, Caretaker Site Office, headquartered in Charleston, South Carolina, began oversight of the facility. The Navy continues to conduct investigations and cleanup in accordance with the facility's Resource Conservation and Recovery Act (RCRA) Hazardous Waste Permit issued by the Kentucky Department for Environmental Protection (KDEP). The Navy transferred about 0.7-acre to the Louisville Naval Ordnance Credit Union in June 2003. In February 2004, the remaining 142 acres of the facility were transferred by deed to the LJCRA.

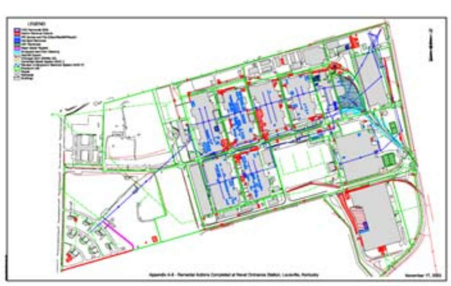

Figure 2. All remedial actions completed through May 2004.

Remediation Summary

The Resource Conservation and Recovery Act (RCRA) of 1976 and Kentucky Revised Statute Chapter 224 require owners and operators of hazardous waste management facilities to clean up contamination resulting from current and past practices. These cleanups, known as corrective actions, reduce or eliminate risks to human health and the environment.

Hazardous Waste Corrective Action at NOS Louisville is required as part of the Hazardous Waste Facility Permit (Permit Number KY5-170-024-173) issued by the KDEP.

Environmental Investigations to determine nature and extent of contamination in soil and groundwater were conducted by the Navy between 1996 and 2000.

During the period 1996 through 2004, the Navy completed a number of cleanup activities (Figure 2) at the facility including the following:

- *Contaminated surface soil removed at 120 locations.*
- *Twelve major sewer repairs.*
- *Ninety industrial process equipment sumps and pits inspected, filled or repaired.*

- *Removed or closed all (49) underground storage tanks.*
- *Cleaned onsite drainage ditches by removing sediment and debris.*
- *Removed nine "hot spots" containing high concentrations of volatile organic compounds.*
- *Performed five major removal actions to address volatile organic compounds that threatened groundwater quality.*
- *Removed concrete and repaved the surface of the former Scrapyard area with asphalt (about 1.25 acres).*
- *Placed an asphalt cover west of Building 102 (about 0.60 acres).*
- *Cleaned Building E, the Former Plating Shop.*

Between 2000 and 2003, the Navy submitted eight RCRA Facility Investigations and seven Corrective Measures Study Reports. These reports (1.) describe the results and present the findings of the sampling and investigations conducted for each area, (2.) evaluate the risks to human health and the environment, and (3.) propose cleanup options for each area.

Kentucky law requires that the Hazardous Waste Permit for the former NOS Louisville be modified at the time the final cleanup remedies are proposed. Seven Statements of Basis have been issued and summarize the cleanup actions taken to date and propose future cleanup remedies at the former Station.

A RCRA Permit Modification had been submitted for public comment in April/May 2004. The permit modification allows Kentucky to enforce the following cleanup remedies.

Figure 3. Land Use Controls, May 2004.

1. KDEP must be notified before any activities are conducted at Solid Waste Management Units (SWMUs) or Areas of Concern (AOCs) where Corrective Action (or cleanup) is still occurring.

2. To protect human health and the environment from contamination that is left in place, the Navy is restricting the use of the land and groundwater in some areas of the facility. The restrictions are defined as "land use controls" (Figure 3). Restrictions are in place to control the following activities at selected sites at the former NOS Louisville:

- *Digging up contaminated soils.*
- *Permanently removing barriers or covers (such as, parking lots, building foundations, or grass cover).*
- *Installing groundwater wells for purposes other than monitoring.*
- *Using the land for purposes other than industrial (except for the ball fields and housing areas).*

3. Each year the Navy will inspect the former NOS Louisville to make certain that the restrictions identified in the permit are being met. The Navy will also make certain that the tenants have the most recent version of land use control plans.

Figure 4. Louisville BRAC Cleanup Team.

The FOSET was signed by Governor Patton in November 2003. The FOST was signed by the Navy in December 2003. The property was transferred by deed in February 2004. The RCRA Permit is scheduled to be modified to include Land Use Controls as final remedies in June 2004.

Partnering Team and Restoration Advisory Board

The successful transfer of NOS Louisville can be attributed to the close coordination and cooperative spirit of the BRAC Cleanup Team (BCT). The Team (Figure 4) consists of members from SOUTHDIV, Navy Caretaker

Site Office, KDEP, U.S. Environmental Protection Agency (USEPA) Region 4, Tetra Tech NUS, and CH2M HILL Constructors, Inc.

Every quarter the BCT met with the Restoration Advisory Board (Figure 5) to advise them of progress toward cleanup goals, discuss planned remedial actions, and explain the early transfer process. The RAB has been in place at NOS Louisville since January 1996. The RAB plans to disband in June 2004 after KDEP signs the Permit Modification.

Cost Avoidance Measures

It has been estimated that over $1 million has been saved due to the following cost avoidance measures:

Use of Geographic Information System (GIS) software for real-time review of the nature and extent of contamination among BCT members. By using this software, the Navy saved time and cost because fewer samples were needed. Those samples that were collected were focused for specific contaminants, at selected locations/depths.
Use of GIS to determine the location, vertical and horizontal extent of land use controls necessary to be protective of human health and the environment resulted in a predictable, reproducible process that the regulators could accept.

Figure 5. NOS Louisville Restoration Advisory Board (RAB).

Project Successes

A number of breakthroughs were achieved along the way to property transfer through the collaborative effort of the BRAC Cleanup Team. The most notable of these are:

Figure 6. Concept plan for future development of Technology Park of Greater Louisville.

- *KDEP agreed that groundwater contamination was limited to the shallow soil overburden on site (7 to 10 feet thickness) and that groundwater contaminated with VOCs had not migrated off the installation boundaries.*
- *The Team agreed to divide the large facility into smaller areas called exposure units. Cleanup goals were established based on the future industrial use of the facility within each exposure unit.*
- *KDEP accepted the Navy’s methodology for lead cleanup at the facility based on statistical analysis of data sets within defined exposure unit boundaries.*
- *Once KDEP was assured that risks to human health and the environment were acceptable, the Navy was able to take a less expensive cleanup approach using Land Use Controls and move forward with an early transfer of the NOS Louisville (Figure 6).*

Points of Contact

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Land Use Control Remedies – *The Way Forward*

New and Evolving Strategies to Further Navy Cleanup Objectives

Background

For nearly two years, the Navy’s ability to finalize Records of Decision (RODs) incorporating Land Use Controls (LUCs) was held hostage as the Department of Defense (DoD) and U.S. Environmental Protection Agency (EPA) debated the scope of EPA’s Post-ROD authorities at DoD facilities on the National Priorities List (NPL). That logjam was finally broken this past January, when representatives from the Assistant Secretary of the Navy, Installations and Environment (ASN, I&E) and Headquarters, Naval Facilities Engineering Command (NAVFAC) brokered a compromise. That compromise came in the form of EPA and DoD sanctioned Navy LUC Principles and Procedures Guidance (“LUC Principles”).

The Navy LUC Principles

The LUC Principles contain both general and specific guidelines for RPMs to follow when negotiating with their regulatory counterparts over how, and to what extent, the Navy will implement (i.e., set in place, inspect, report on and enforce) LUCs at Navy NPL facilities whether they are active, closed or closing. At the heart of the LUC Principles lies a mutual EPA-Navy acknowledgement that the *“most efficient framework”* for implementing LUC remedies at those facilities lies in adherence to three basic precepts, namely:

- *The use of “standardized” Federal Facility Agreements (FFAs);*
- *Having site LUC Objectives stated in clear & concise RODs; and*
- *The use of LUC Remedial Designs (LUC RDs) or Remedial Action Work Plans (RAWPs) to document all LUC implementation (including long term oversight) actions to be undertaken.*

In addition to specifying the basic objective(s) to be achieved (e.g., prohibiting groundwater usage) the LUC Principles provide that each LUC ROD should explain why the selected LUCs are necessary, and who will be responsible for implementing those controls. The guidance requires that each LUC ROD should refer to the intended use of a LUC RD or RAWP to document exactly how the LUCs described in the ROD will be implemented. The LUC Principles also specifically provide that the LUC RD or RAWP should describe *"those actions that are needed to ensure viability of both long-term engineered and institutional control remedies".* Thus, for example, if signage like that shown in Figure 1 is to be used, then the LUC RD or RAWP would need to address how the Navy will maintain it for as long as needed to help ensure overall remedy protectiveness.

Recent LUC RD Success Stories

In April 2004, NAVFAC Southern Division (SOUTHDIV) obtained final NAVFAC and ASN (I&E) approval for the execution of two precedent setting LUC RDs. The first of these was for Site 45 at the former Naval Air Station (NAS) Cecil Field in Jacksonville, Florida. The second addressed the selected LUC remedy for combined Operable Unit (OU) 2/3 at the Navy's Industrial Reserve Ordnance Plant (NIROP) in Fridley, Minnesota. In combination with the LUC RD finalized by NAVFAC Atlantic in June 2004 for the Naval Amphibious Base, Little Creek, Virginia, the NAS Cecil Field and NIROP Fridley LUC RDs provide the rest of the NAVFAC Community with examples of Secretariat level approved LUC remedy implementation documentation. All three of these new LUC RDs are fairly concise documents with approximately six pages.

Figure 1. Typical LUC Site Signage.

Because transfers of ownership were being contemplated at the time, the NAS Cecil Field and NIROP Fridley LUC RDs address both the Navy's and prospective new owners’ long term LUC oversight responsibilities. At both facilities, the intended transferees agreed to annually inspect the LUCs to be imposed via our deeds of conveyance. They also agreed to certify annually that they were complying with all LUC related requirements. Had they not agreed to do so, then our regulatory partners would have undoubtedly looked to the Navy to assume those oversight actions. Other terms and conditions included in these two LUC RDs included:

- *The opportunity for regulatory agency review of LUC provisions to be included in the transfer deeds;*
- *The requirement for notice to the regulators of LUC violations by any new owner / user should the Navy become aware of such;*
- *LUC modification or termination procedures should either the Navy or a new owner desire to change or end a LUC(s).*

Next Step – Private Sector Parity?

Navy LUC policy clearly continues to evolve. A possible next step would be for the Navy to pursue "*parity"* with private industry. Under that concept, the Navy (and our transferees at closing facilities) would be treated no differently than any other private sector landowner (and their prospective purchasers) with regards to having to assume long-term LUC inspection and reporting responsibilities at any active or closing Base whether listed on the NPL or not. Only to the extent that existing Federal law(s) might actually preclude our ability to comply with a particular LUC oversight requirement being imposed on private industry would we need to work out an alternative approach with our Federal and/or State regulatory partners.

Is "Parity" Even Plausible?

The legal basis for the Navy to seek parity is actually well founded in Federal law. Similar to other Federal environmental statutes, the Federal facility provisions in both the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and the Resource Conservation and Recovery Act (RCRA), provide that the Federal Government is only subject to the general requirements contained therein (and thus, to any Federal or State regulations flowing from them), in the *"same manner and to the same extent as"* any non-Governmental entity. (See Title 42, United States Code, Section 9620(a)(1) and Title 42 United States Code, Section 6961(a).

There is one notable exception to the "same manner same extent" rule. Section 120 of CERCLA does impose certain specific property transfer related requirements on the Federal Government (e.g., deed covenants) not similarly applicable to the private sector. However, those requirements do not speak specifically to whether a Federal agency must assume any long-term LUC oversight obligations at its disposal of contaminated Federal property. And while it is legally permissible for delegated State environmental programs to have more stringent requirements than their Federal counterparts, in order to pass legal muster they must still be uniformly applied to *all* regulated entities, unless a State can enunciate a rationale basis for distinguishing between Federal facilities and other regulated entities.

What Might Achieving Parity Mean?

Looking at the various EPA Regions and States within SOUTHDIV's Area of Responsibility (AOR), there does not appear to be a consistent approach towards regulatory imposition of long-term LUC oversight requirements on current or former owners of private properties. Approaches seem to vary amongst EPA-lead Superfund, State-lead Petroleum Underground Storage Tank (UST), Brownfields and similar State authorized voluntary cleanup programs. At least a few states are taking similar approaches with respect to approving LUC remedies at RCRA permitted facilities. For example, Florida and South Carolina have begun adding LUC remedy related terms and conditions to both private sector and Federal facility corrective action permits as those permits come up for renewal. As modified, these permits will now require that the permittee build LUC oversight strategies into their draft Corrective Measures Implementation (CMI) Workplan submissions.

Overall, until greater consistency is established amongst the EPA Regions and various State environmental agencies on how they will, or will not, impose long-term LUC oversight burdens on private industry, it is hard to predict with any degree of certainty what gaining parity might actually mean for the Navy. Nonetheless, given recent regulatory demands for continuing Navy involvement in overseeing LUCs at some of our closing bases, one can certainly imagine that the level of those obligations might be reduced if parity were the standard to be applied to those transitioning Navy facilities. Further support for this notion can be found in two fairly recent national initiatives, which appear to favor the imposition of less burdensome oversight obligations on former private owners of contaminated property.

New Model Uniform Law Initiative

In August 2003, a new model uniform law on LUCs known as the "*Uniform Environmental Covenants Act" (UECA* was approved by the National Conference of Commissioners on Uniform State Laws. As intended by its drafters, that model law is now under consideration by at least a few State legislatures for possible enactment into State law.

Under UECA, LUCs would be fully enforceable via restrictive covenants recordable either before or at the transfer of ownership of contaminated property. The Act calls for giving Federal and/or State regulatory agencies covenant *"holder"* status and thus, a direct LUC oversight and enforcement role. More importantly, however, it appears that former owner involvement is not *mandated* but rather *allowed*, in order to take in account the reality that a former owner /polluter might actually want to stay engaged in overseeing LUC compliance by future users of the property because of possible lingering liability concerns.

Latest Brownfields Changes

Even before the model UECA was developed, Congress interjected itself into the national LUC debate when, in early 2002, it amended CERCLA by enacting the *Small Business Liability Relief and Brownfields Revitalization Act.* That Act appears to place particular importance on new owner LUC compliance by tying a private party's status as either a "*Bona Fide Prospective Purchaser"* or an *"Innocent Landowner"* and the associated liability protections afforded under the law, with their compliance with all site remedy related LUCs. However, like the UECA, this statute does not appear to directly impose any specific long-term LUC inspection or reporting obligations on former property owners. Instead, the focus appears to be on promoting LUC compliance by all new owners/users of the property.

Conclusion

Recent resolution of the DoD/EPA Post- ROD authority dispute has opened the door for all NAVFAC RPMs to begin finalizing long pending CERCLA LUC RODs. While the LUC Principles have certainly put the Navy's Installation Restoration Program (IRP) back on track towards achieving cleanup objectives, they likely will not be the last word on whether or to what extent, the Navy should assume any long-term LUC oversight obligations in order to meet those objectives or to facilitate the expeditious future disposal of contaminated Navy properties. Recent national initiatives in the LUC arena would appear to make the goal of achieving equality of treatment with the private sector a potentially fruitful long-term LUC goal for the Navy. Only time will tell if that is truly a goal worth pursuing.

Point of Contact

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Advances in Nanotechnology for Environmental Remediation

The terms, nanoscience and nanotechnology, were coined in the 1990s, are now common buzzwords. Nanoscience refers to study of phenomena that occur on the nanoscale – dimensions on the order of a small molecule. The U.S. Government has recently created a 16-agency National Nanotechnology Initiative (NNI) and President’s 2005 budget provides $1 billion to focus on the application of this technology in various areas, including pollution control and remediation.

Nanotechnologies have the potential to solve several environmental problems including the control of emissions from a wide range of sources, the development of new “green” technologies that minimize production of undesirable by-products, and the remediation of existing waste sites and polluted water sources. At the nanoscale, it may be possible to effect the removal of the finest contaminants from water supplies (<300 nm) and air (under 20 nm), and to perform continuous measurement and mitigation in large areas of the environment.

What is Nanotechnology?

Nanotechnology refers to nearly any process or application involving particles less than 100 nanometers (a nanometer is one-billionth of a meter). These particles are composed of on the order of thousands of molecules, which is considerably less than most common particles (Figure 1). To put this in perspective, a single cell bacterium is approximately 1 micrometer or 1/10 to 1/1,000 of nano-sized particles. In nanotechnology applications, the molecules are configured in a manner that enables them to exhibit specific properties because the quantum effects of atoms tend to be most strongly exhibited when the number of molecules comprising particles is small. As a result, the chemical and physical properties of nanoparticles can be considerably different than larger particles. Nanoparticles may exhibit different densities, hardness, thermodynamic properties, and conductivities than larger particles.

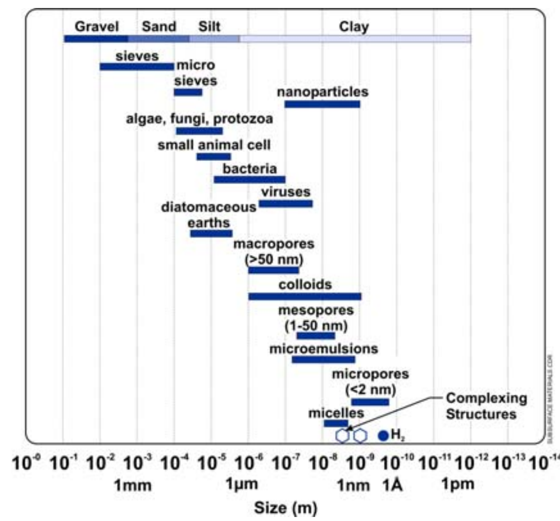

Figure 1. Schematic comparison of size range of nanoparticles.

Nanotechnology and nanoscience techniques have been around for centuries. Benjamin Franklin was experimenting with nanotechnology years ago. Once in England, he put a teaspoon of oil on a choppy lake and the surface of the water became as smooth as glass. The oil spread into a single layer (only a single molecule thick) and changed the properties that govern how the wind interacted with the water. Today, scientists and engineers are gaining an integrated understanding of the environment, and novel experimental, theoretical, and computational methods for characterizing nanostructures are available to begin taking advantage of nanotechnology.

Nanotechnology and the Environment

Complex physical and chemical processes involving nanoscale structures are essential to phenomena that govern the sequestration, release, mobility, and bioavailability of nutrients and contaminants in the natural environment. Processes at the interfaces between natural, physical, and biological systems have relevance to several environmental issues. Increased knowledge of the dynamics of processes specific to nanoscale structures in natural systems not only will improve understanding of transport and bioavailability but also lead to development of nanotechnologies useful in preventing and mitigating environmental harm.

Remediation Applications

The nanotechnologies developed to date for remedial applications at hazardous waste sites involve the use of nano-sized single or bimetallic particles (such as iron combined with palladium, platinum, silver, nickel, cobalt, and copper). Reactions of zero-valent iron occur when iron corrodes in the presence of water to form Fe^{3+} or Fe^{2+} and hydrogen. It is not clear whether the reaction occurs at the iron-particle surface or whether the chlorinated hydrocarbon reacts with Fe^{2+} or hydrogen in the presence of iron, which acts as a catalyst. Regardless, the reductive dechlorination reaction consistently cleaves chlorine atoms from chlorinated hydrocarbons in a process that produces hydrogen chloride and non-chlorinated hydrocarbons (e.g., ethane or ethene). The iron corrosion occurs on the surface of the iron; the greater the surface area, the more efficient the reaction. The nanoscale application of zero-valent iron takes advantage of the large surface area per unit weight of the nanoparticles to increase reaction rates considerably over larger particles, such as granular or powdered iron, that have a smaller surface area-to-weight ratio.

Nanoscale iron has the ability to catalyze the abiotic dechlorination of organic solvents and many other organic contaminants, including chlorinated methanes, chlorinated and non-chlorinated aromatics, nitroaromatic compounds (nitrobenzene, nitrotoluene, dinitrobenzene, and dinitrotoluene), Freon, certain pesticides, and even polychlorinated biphenyls. Metal contaminants (e.g., chromium, mercury, lead, arsenic, and uranium) are reduced to insoluble inorganic species in presence of iron nanoparticles.

A company specializing in injecting solutions into aquifers and pneumatic fracturing technologies injects iron microscale particles into aquifers as slurry or dry using nitrogen as carrier gas. Like other in-situ remediation technologies, the technology's success is dependent on the ability to deliver the iron particles, which are on the order of 100 micrometers in size (much larger than nanoparticles). An interesting application is the marriage of iron-based reactions with nanotechnology.

Nanoscale iron particles are 10 to 1,000 times more reactive than conventional iron powders on an equivalent weight basis as nanoscale iron has a considerably greater surface area-to-mass ratio (surface areas of nanoscale iron and commercially available iron are 33.5 m^2/g and 0.9 m^2/g, respectively). The advantages of nanoscale particles are as follows:

- *a) It can be injected as slurry directly into contaminated aquifers, even those with relatively small interstitial spaces between the aquifer particles.*
- *b) This technology can be applied to bedrock aquifers, because nanoscale iron can migrate in fractures and fissures present in bedrock aquifers.*
- *c) Nanoparticles can remain reactive towards contaminants in soil and water for extended periods (>4-8 weeks), and can flow with groundwater over 20 m distance, and*
- *d) Nanoparticles can also remain in suspension for extended periods of time under suitable conditions (surface charge, pH, presence of dispersing agent, and other factors) to establish an in-situ treatment zone.*

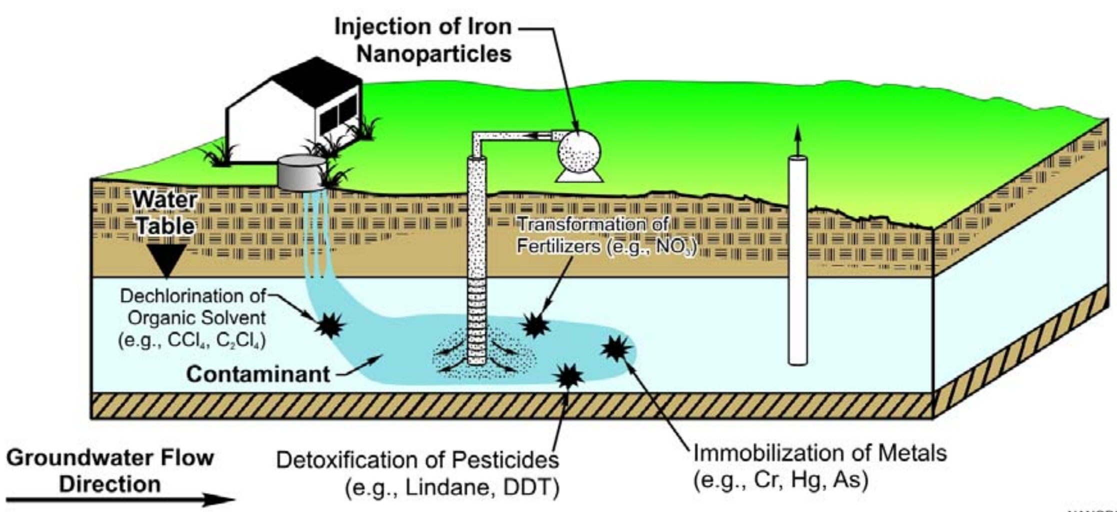

Figure 2. Nanoscale particles for in-situ application.

A few reported and potential applications of nanoparticles for remediation are indicated below (also see Figure 2).

- *A pilot test conducted at a site in North Carolina in which trichloroethene (TCE) was present in a bedrock aquifer. It was treated by injecting a solution of nanoscale iron particles through a well. TCE concentrations at the injection well and a monitoring well located 7.5 m downgradient of the injection well decreased by over 90 percent, from an initial concentration of approximately 14,000 µg/L to around the drinking water standard of 5 µg/L.*
- *Nanoscale iron injection has also been used by NAVFAC at the Hunters Point Shipyard in San Francisco, California. Reduction of TCE to ethene and chloride occurred rapidly with a reduction of 99.2 percent within the treatment zone.*

- *Combining nanoscale particles with surfactants and/or biodegradable oil also provide a unique technique to attack dense nonaqueous phase liquid (DNAPL) contamination and other contaminants of concern. The chemical additives create an emulsion of fine droplets called micelles. When the micelles come into contact with the DNAPL, the chlorinated solvent molecules preferentially absorb into the oil due to hydrophobicity. Once absorbed, the DNAPL reacts with the nanoscale metal particles, effectively destroying the contamination. As the contaminants are destroyed within the micelle, a concentration gradient forms across the micelle surface. The gradient drives more contaminant molecules to absorb into the micelle where the nanoparticle-contaminant reaction occurs.*
- *Nanostructured materials, like anatase (TiO_2), can oxidize organic contaminants, scavenge heavy metals. UV-illuminated nanoscale TiO_2 can be employed to clean atmospheric contaminants including hazardous organic chemicals, cells, and viruses. As the surface chemistry of the nanostructured materials is better understood, it will be possible to tailor the surface in nanostructured material-mediated reactions to minimize the generation of wastes.*
- *Nanoparticles have the flexibility for both in situ and ex situ deployment as they are easily deployed in slurry reactors for the treatment of contaminated soils, sediments, and solid wastes.*
- *Nanoparticles can be anchored onto a solid matrix (e.g., activated carbon or zeolite) for enhanced treatment of water, wastewater, or gaseous process streams. Figure 3 shows a schematic of a functionalized mesoporous nanocomposite consisting of a silicate framework of cylindrical pores that give the material a honeycomb appearance, with concomitant large surface area and nanometer porosity. These nanocomposites are very effective at sequestering heavy metal ions from waste stream. The ability to incorporate nanoscale inclusions in composites has the potential to produce materials with improved properties and tailored to specific applications. This can produce systems with increased environmental robustness, resulting in longer service life and reduced overall system costs and replacement needs, and reduced environmental impact.*
- *Coating the nanoscale particles with a chemically selective material enhances the ability of degradation.*

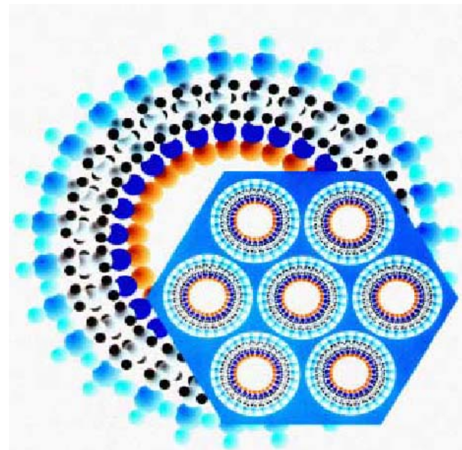

Figure 3. Schematic of a functionalized mesoporous nanocomposite.

Nanoscale particles have a greater affinity for transport in the environment than larger-scale particles. The possibility exists that the same properties that make nanoscale particles beneficial, their small size and greater reactivity, also make them detrimental to the environment. For example, particles that are considerably smaller than the interstitial spaces in the aquifer materials could migrate rapidly in the groundwater systems. It is difficult to predict how regulators will react to a wide scale injection of mobile nanoscale iron or various bimetallic particles in the groundwater. Although iron is not considered hazardous and is unlikely to pose a concern as nanoscale particles, how it will affect humans or other organisms has not been studied.

Conclusions

Environmental applications of nanotechnologies demonstrate their potential to revolutionize entire industries and displace major existing technologies. However, costs and risks of transitioning from discovery to commercialization need sponsored mechanisms to facilitate large companies to undertake the wide range of development projects to bring nanotechnologies into practice.

Point of Contact

For more information on advances in environmental applications of nanoscale technologies, you can contact:

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Southern Division Partnering Teams Use Web Technology For Project Collaboration

The Internet has changed the way organizations do business, enabling real-time processing and instant communication facilitating enhanced productivity and reduced costs. Organizations now reside in a "knowledge market" in which well-informed decisions depend on the use of information technology to streamline operations. To realize these benefits, institutions must empower their workforces to dynamically access, create, send, and receive information through knowledge-based and collaborative interactions. Web-based enterprise information porticos provide a solution to many of the information management complexities currently facing organizations.

Project Summary

Administration of the significant amount of environmental data and related information generated during typical full-scale remedial investigations requires the use of many applications and resources such as a Geographic Information System (GIS) and Document Management System (DMS) as well as other team-orientated tools such as discussion forums and corporate calendars. Consequently, related information resources are often warehoused at various locations, and stakeholders may unnecessarily use a good deal of time and effort establishing, collecting, and organizing information necessary to make better business decisions.

Figure 1. IR Collaboration Gateway access page.

To address this concern, Naval Facilities Engineering Field Division SOUTH’s (SOUTHDIV’s) Comprehensive Long-Term Environmental Action Navy (CLEAN) contractor Tetra Tech NUS, Inc., implemented a secure password protected Web-based Enterprise Collaboration Gateway that enables efficient and effective access to environmental restoration data by all members of the partnering teams (Figure 1). The Gateway also provides a central location for storing and managing in an environmental GIS all site data collected by the CLEAN and SOUTHDIV’s diversity of large and small business remediation contractors.

The Gateway provides an infrastructure for tightly integrated and fully functional components. The Gateway applies Internet technology with a standard Web browser interface to allow team members from across and outside the enterprise access to information and associated data. The Gateway framework allows embedded systems to integrate with applications to meet the specific needs of all the team stakeholders (Figure 2).

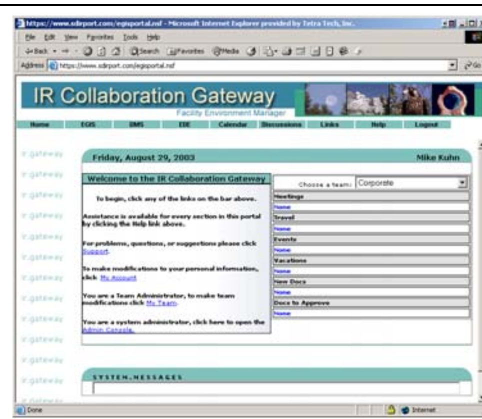

Figure 2. Home displays user’s pertinent data items for the day with message board.

The IR Collaboration Gateway is the entry point to provide team members with easy access to information they need to make better decisions on a near real time basis. It harnesses embedded information systems by extending their reach to more stakeholders while facilitating cooperation among members through collaborative interactions. It expedites the distribution of information through digitally delivered communications, while reducing costs by eliminating the need to produce and manually distribute paper documents (Figure 3).

The Gateway managed by SOUTHDIV’s CLEAN III substantially improves the productivity and decision-making ability of project teams dealing with environmental cleanup and property transfer initiatives.

Regulatory Requirements/Community Involvement

The Gateway expedites the delivery of critical, up-to-the-minute information to stakeholders in various locations. The use of the Gateway during project team meetings to provide integrated access to up-to-the-minute data has become an essential decision-making tool by facilitating collaborative interactions between team members. Use of the Gateway at Restoration Advisory Board (RAB) and public meetings allows timely access to information required to answer individual queries. The ready access to all data by regulators and other partnering team members further builds trust and enhances teamwork required to meet the common goal of efficiently remediating sites.

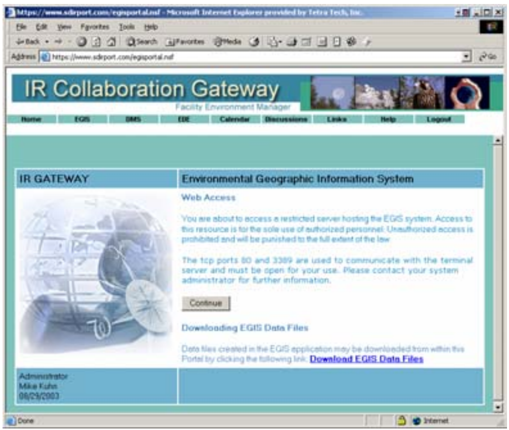

Figure 3. Access to Environmental Geographic Information System (EGIS).

Construction Challenges

A significant obstacle to efficient and informed decision making has been the inability of all stakeholders to access data in a timely fashion and to participate in collaborative evaluation efforts. Advancements in Internet technology have allowed enterprises to provide timely access to critical information to users across and outside the organization, and the Gateway framework allows embedded systems to integrate applications to meet specific stakeholder needs.

Cost Avoidance Measures

Use of the Gateway enables real time decision making during meetings facilitating dynamic work plans and cleanup decisions. The central location of data storage and analysis of data collected by a diversity of contractors including small businesses, EMACs, and BOAs helps ensure data consistency and integrity and avoids duplicative GIS efforts (Figure 4).

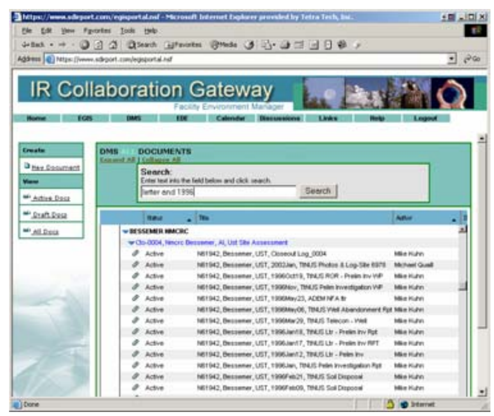

Figure 4. Full document upload and download with approval cycles.

Project Successes

The real value of Gateway technology manifests itself in the ability of team members to leverage access to large quantities of data across functional boundaries. The increased ability of stakeholders at various locations to identify, access, and analyze the data they need, when they need it, without accumulating and searching through large volumes of paper documents, significantly increases productivity and promotes project success. An additional benefit is the increased consistency, accuracy, and manageability of communications through the Gateway’s information unification capabilities.

Lessons Learned

Accessibility of information from a central arena, possible only by using Gateway technology, is integral in satisfying requirements necessary for stakeholders; however, the evolution of the Gateway managed by SOUTHDIV's CLEAN is a work in progress. Additional functionality and tools are consistently being evaluated to meet the needs of all decision makers and stakeholders on the partnering teams.

Points of Contact

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Volunteer Regulatory/Industry Group Releases Seven Environmental Documents

The Interstate Technology & Regulatory Council (ITRC) continues to publish documents that confront the technical and regulatory issues of implementing innovative technologies for environmental characterization, cleanup, and monitoring. Since 1996, ITRC has published over 50 documents to help regulators, consultants, the regulated community, and the public, understand how emerging technologies should be used and regulated to solve environmental problems. The newest publications in the ITRC inventory are:

- *Technical and Regulatory Guidance for Design, Installation, and Monitoring of Alternative Final Landfill Covers (ALT-2, December 2003)*
- *Vapor Intrusion Issues at Brownfield Sites (BRNFLD-1, December 2003)*
- *Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management (SCM-1, December 2003)*
- *Technical and Regulatory Guidance for Constructed Treatment Wetlands (WTLND-1, December 2003)*
- *Making the Case for Ecological Enhancements (ECO-1, January 2004)*
- *Technical and Regulatory Guidance for Using Polyethylene Diffusion Bag Samplers to Monitor Volatile Organic Compounds in Groundwater (DSP-3, February 2004)*
- *Issues of Long-Term Stewardship: State Regulators' Perspectives (RAD-3, July 2004)*

In addition to these documents, ITRC's library includes guidance on characterizing and cleaning up dense, nonaqueous-phase liquids; radionuclides; small arms firing ranges; and unexploded ordnance. ITRC volunteers working in technical teams have also produced guidance on the use of in situ bioremediation, in situ chemical oxidation, permeable reactive barriers, phytotechnologies, and constructed treatment wetlands.

These ITRC products and others can be downloaded from the ITRC Web site at www.itrcweb.org by clicking on "Guidance Documents." To receive a hard-copy ITRC document in the mail, e-mail your request to itrc@wpi.biz.

ITRC is a state-led group that works to overcome regulatory barriers to the deployment of innovative environmental technologies. ITRC participants come from state regulatory agencies, Federal agencies concerned with environmental cleanup, environmental consulting firms, and technology vendors. These diverse experts work together in technical teams to develop documents and training to help regulators develop consistent, streamlined approaches to regulating innovative technologies. ITRC products also help environmental consultants improve the way innovative technologies are deployed.

Point of Contact

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August 5, 2004
Underground barrier keeps Mare Island waste from wetlands

By Barry Eberling

Heavy equipment with Weston Solutions works to build a slurry wall to contain pollutants at Mare Island in Vallejo. (Photo by Gary Goldsmith)

VALLEJO -- On one side is an old Mare Island Naval Shipyard dump, full of buried scrap metal, solvent-soaked rags, paint sludge, sandblast abrasives and all matter of shipboard waste.

And on the other is a natural treasure. Such rare creatures as the salt marsh harvest mouse live in wetlands, tidal marshes and mudflats bordering San Pablo Bay.
In between? An underground barrier designed to keep the pollutants out of paradise.

Workers are digging a trench 3 feet wide and 25 feet deep, until they reach clay soils. They mix soil, water and bentonite, a gray clay found in Wyoming and Utah. They push this slurry into the trench with bulldozers.

The result: a subterranean wall of slurry. "Impermeable goo" is how Dwight Gemar of Weston Solutions described it in layperson's terms.

This is just one more step in the Mare Island cleanup. Vallejo's plans call for the 5,460-acre island to one day be a mixture of homes, businesses, industry, parks and wildlife areas. The city wants to take a naval base that existed from 1852 until 1996 and find new uses for it in the 21st century.

But that 70-acre dump site is an unwanted legacy. The Navy used the original dump from 1965 until 1977 and an adjacent area through 1989. The site also has an industrial waste treatment plant and unlined sumps that received an estimated 4.5 million gallons of waste oil.

So the Navy is paying $54 million to clean up its mess. The money goes to Vallejo, which hired Weston Solutions to oversee the work.

The ultimate cleanup plan for the dump could emerge later this year. Options include hauling the waste away or leaving it where it is and putting some type of cap over it.

Then, someday, the dump site might become a park, where people can play baseball and fly kites on grassy fields. Mare Island reuse planners have discussed the park. But planning has not gone beyond that initial idea.

For now, the goal is simply to keep the waste where it is.

Besides the slurry wall trench, workers are digging a trench inside the dumpsite for a drainage system. They've come across ammunition, all of it dead. Dead, but in one case extremely smelly.

The Navy filled a shell with lima beans to simulate the weight of a live explosive for handling in training.

"Nothing smells worse than 50-year-old lima beans," said Larry Maggini of Weston Solutions.

Workers also found granite blocks they think came from dry dock number one. The old blocks now sit near the dump gates, providing a makeshift entrance feature to the project.

The U.S. Fish and Wildlife Service has its San Pablo Bay refuge near the dump. Refuge manager Christy Smith went on a recent tour to see workers creating the slurry barrier that is to keep the toxic materials away from the wetlands.

"I think they're handling it very well," Smith said.

Pickleweed growing in vast quantities near the trenchwork shows the stakes. This is salt marsh harvest mouse habitat.

The salt marsh harvest mouse is found only near San Francisco, San Pablo and Suisun bays. It is protected by the Endangered Species Act, both State and Federal. The 3-inch-long mouse lost about 84 percent of its habitat since 1850 due to habitat conversion, according to the U.S. Fish and Wildlife Service.

Workers started digging the slurry trench in June. When finished, the trench will be 7,200 feet long.

It's just one more step in the vision of someday turning this site into a park. Then the name of the street running through here can change, having become obsolete. The street is called Dump Road.

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Point of Contact

(619) 532-0975

Technology Transfer (T2) News

Visit Our Web Site Address:
www.ert2.org

U.S. Environmental Protection Agency (EPA) Provides New Guidance for Monitoring at Hazardous Waste Sites

An effective Monitoring Plan is a key management tool in assessing the performance of a remedial action and its protectiveness of human health and the environment. The U.S. EPA has developed a new guidance document to aid in the development of technically defensible and adaptive Monitoring Plans for hazardous waste sites as part of their "One Cleanup Program" initiative. The Department of Defense (DoD) has utilized this program at several sites and NAVFAC's Risk Assessment Workgroup (RAW) helped to review and comment on the draft guidance document. The new document was issued in January 2004 as part of US EPA OSWER Directive No. 9355.4-28 and is titled *Guidance for Monitoring at Hazardous Waste Sites: Framework for Monitoring Plan Development and Implementation*.

The guidance document is targeted at remedial project managers (RPMs) who have completed the site characterization phase and are in the process of implementing remedial or removal actions at their sites. It presents a six-step framework for developing and implementing Monitoring Plans including the identification of monitoring objectives and decision rules or exit criteria that allow for terminating various site activities. The framework is iterative and is meant to support adaptive and optimal management of the site activities and the monitoring program. The six major project steps outlined include identifying monitoring objectives, developing monitoring plan hypotheses, formulating monitoring decision rules, designing the monitoring plan, monitoring and characterizing results, and implementing management decisions based on the results. The development of a sound Monitoring Plan will help to maintain the focus of data collection and to provide direct support of the monitoring objectives, decision rules, and subsequent management decisions. For more information, please view the document at the following Web site link:

Guidance for Monitoring at Hazardous Waste Sites: Framework for Monitoring Plan Development and Implementation

http://www.epa.gov/superfund/action/guidance/dir9355.pdf

Navy Policy Released on Optimizing Remedial and Removal Actions Under the Environmental Restoration (ER) Program

Initial decisions made early during the remedy selection and design phases of the ER Program have significant long-term financial and performance implications on site cleanup. An optimized approach to remedy selection and design is appropriate to facilitate cost-effective and protective cleanup. The Chief of Naval Operations (CNO) has published a new policy to establish procedures for optimizing the screening, evaluation, selection, design, and implementation for long-term operation and management of response actions conducted under the ER Program. This policy was issued in April 2004 and is now available on the NAVFAC ERB Web Site for review, along with a newly released companion document that provides key optimization concepts for implementation during the Feasibility Study (FS), Record of Decision (ROD), and Remedial Design (RD) phases of a project. The links are provided below to view the policy and new guidance document:

DON Policy for Optimizing Remedial and Removal Actions Under the Environment Restoration Programs

http://enviro.nfesc.navy.mil/erb/erb_a/regs_and_policy/don-policy-ra-optimiz.pdf

Guidance for Optimizing Remedy Evaluation, Selection and Design

http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/ug-2060-opt.pdf

Final Amphibian Ecological Risk Assessment Guidance Manual Now Available

Amphibians play a key ecological role serving both as important consumers and predators in wetlands. However, limited amphibian ecotoxicity data are available and previously no standardized procedures existed to evaluate the potential toxicity of contaminated sediments to amphibians. NAVFAC's RAW has developed a new guidance manual that presents a standardized risk assessment protocol for evaluating potential risks to amphibians at Navy wetland sites. This protocol may help the Navy avoid costly and unnecessary wetland alteration based on use of inappropriate ecological endpoints**.**

The final guidance document titled *Development of a Standardized Approach for Assessing Potential Risks to Amphibians Exposed to Sediment and Hydric Soils* is available at the following link: http://web.ead.anl.gov/ecorisk/methtool/risk/index.cfm. In addition, a multimedia technology transfer tool is available at www.ert2.org, which details the new laboratory toxicity test for amphibians developed by NAVFAC.

In addition, other new documents of interest developed by the Risk Assessment Workgroup are listed below:

- Guidance for Habitat Restoration Monitoring: Framework for Monitoring Plan Development *available at* http://web.ead.anl.gov/ecorisk/related/
- Reviewing Ecological Risk Assessment Deliverables *Issue Paper available at* http://web.ead.anl.gov/ecorisk/issue/
- *Case study example of a* Watershed Contaminated Source Document for NAS Dallas *available at* http://web.ead.anl.gov/ecorisk/case/

Point of Contact

(805) 982-1656

Naval Facilities Engineering Command

RITS

Fall 2004

Remediation Innovative Technology Seminar

Overview

The **Remediation Innovative Technology Seminar (RITS)** provides training on new and innovative technologies, methodologies, and guidance under the Navy's Installation Restoration Program. The Naval Facilities Engineering Command (NAVFAC) sponsors RITS in coordination with its Engineering Field Divisions (EFDs), Activities (EFAs), and its Engineering Service Center. RITS training serves as one of many ways the Navy promotes innovative technologies to achieve site restorations more efficiently, cost effectively, and with higher performance.

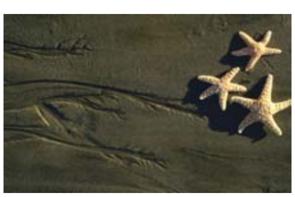
While the RITS is primarily for the Navy's Installation Restoration and Base Realignment and Closure (BRAC) environmental professionals, it is also available to other DoD personnel, the Navy's environmental cleanup contractors, and environmental regulators.

Topics for Fall 2004

Naval Installation Restoration Information Solution (NIRIS) – This RITS presentation will introduce Remedial Project Managers (RPMs) to Naval Installation Restoration Information Solution (NIRIS). Restoration projects typically have thousands of spatial data records. NIRIS uses web and desktop based Geographic Information Systems (GIS) and related tools to help RPMs effectively analyze spatial distribution and correlate large volumes of data. NIRIS tools can help RPMs make smart cleanup decisions, and collaborate with regulators, the public, and other stakeholders. We'll introduce basic GIS concepts and terms, discuss how to use NIRIS tools, and identify the deployment schedule.

Vapor Intrusion Part 1: Overview - In Part 1 of the vapor intrusion presentation, RPMs will learn the essentials of the vapor intrusion issue, including reasons why and when you need to be concerned with it. Background facts, basic principles, and regulatory guidance documents will be discussed. We'll also provide an overview of the EPA vapor intrusion guidance, alpha factors, and a summary of the current State regulations and policies. Since vapor intrusion has recently taken the forefront as a major risk pathway at cleanup sites, this topic is very relevant to clean-up projects being planned today.

Vapor Intrusion Part 2: Evaluating the Risk - Continuing with the vapor intrusion topic, Part 2 will focus on risk pathway assessment strategies. RPMs will learn methods to assess upward vapor risk such as indoor air measurements, modeling, and soil vapor surveys. Additionally, course material will provide practical approaches for determining risk, such as which method to use and when, sampling considerations, and sampling strategies. Case histories and a class exercise will also be presented.



Chemical Fingerprinting - This presentation will introduce RPMs to high-quality chemical fingerprinting analysis. This tool, when used in combination with Rapid Sediment Characterization (RSC) tools, can optimally and cost-effectively distinguish Navy sediment contamination from non-Navy sources. When non-Navy sediment sources are suspected, it is important that all sources be identified and background or anthropogenic levels of contamination be established. We'll provide you with the latest information on this advanced fingerprinting approach. A case study will also be presented.

Agenda

0800 – 0830 Welcome and Introductions
0830 – 1000 Naval Installation Restoration Information Solution (NIRIS)
1000 – 1130 Vapor Intrusion Part 1: Overview
1130 – 1230 Lunch
1230 – 1430 Vapor Intrusion Part 2: Evaluating the Risk
1430 – 1600 Chemical Fingerprinting

Fall 2004 Schedule

Date	*Location*	
26 Oct Tuesday **Pearl Harbor, Hawaii** Naval Facilities Engineering Command, Pacific	**HRSC Training Center 2nd Floor Room #1** 94-810 Moloalo Street Waipahu HI 96797 (808) 671-1643 ext. 208 or 209	
28 Oct Thursday **San Diego, California** Southwest Division	**Holiday Inn San Diego on the Bay** 1355 North Harbor Drive San Diego CA 92101 (800) 877-8920	(619) 232-3861
3 Nov Wednesday **Norfolk, Virginia** Naval Facilities Engineering Command, Atlantic	**Hilton Norfolk Airport** 1500 North Military Highway Norfolk VA 23502 (800) 422-7474	(757) 466-8000
4 Nov Thursday **Arlington, Virginia** EFA Chesapeake	**U.S. Navy Memorial Foundation** 701 Pennsylvania Avenue Washington DC 20004 (202) 380-0733	
16 Nov Tuesday **Philadelphia, Pennsylvania** EFA Northeast	**EFA Northeast CBO Conference Room 1** 10 Industrial Highway Lester PA 19113-2090 (610) 595-0567 x146	
18 Nov Thursday **Charleston, South Carolina** Southern Division	**Sheraton North Charleston Hotel** 4770 Goer Drive North Charleston SC 29406 (888) 747-1900	(843) 747-1900

Registration

There is a new link to the Online Registration Form on the NAVFAC Environmental Restoration & BRAC Website. The "NAVFAC Registration" link is at the bottom of the beige navigation bar on the left. Register online, or by phone (805) 982-5575 DSN 551-5575, or fax (805) 982-3694 DSN 551-3694, no later than one week prior to the seminar you plan to attend. Please provide the following information:

- Seminar Date and Location you plan to attend
- Name
- Organization/Company
- Phone Number
- Fax Number
- E-mail
- Address

Due to space limitations, registration for Contractors is limited to those currently working in the Navy's Installation Restoration Program. Contractors must also provide:

- Contract Number
- Navy Point of Contact

You must make your own lodging arrangements. There is no cost to attend the seminar. No form DD1556 is required

CECOS Fall 2004
Restoration Training Schedule

Environmental Background Analysis	20 - 21 Oct 2004	Norfolk, VA
GIS/Geostatistic	25 - 28 Oct 2004	Washington, DC
Health & Environmental Risk Comm	02 - 04 Nov 2004	San Diego, CA
Ecological Risk Assessment	16 - 18 Nov 2004	San Diego, CA
Optimizing Remedy Selection	30 Nov - 2 Dec 2004	Silverdale, WA
Environmental Data Quality Assurance	06 - 10 Dec 2004	Charleston, SC

To register for these classes - please visit CECOS website: https://www.cecos.navy.mil.

Point of Contact

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